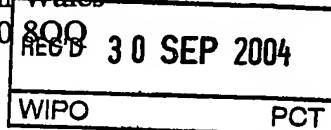




INVESTOR IN PEOPLE

The Patent Office  
 Concept House  
 Cardiff Road  
 Newport  
 South Wales  
 NP10 8QQ



## PRIORITY DOCUMENT

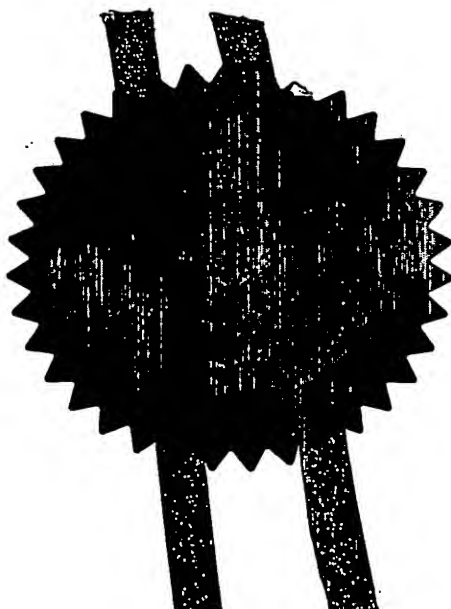
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 COMPLIANCE WITH RULE 17.1(a) OR (b)

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

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Dated

21 September 2004



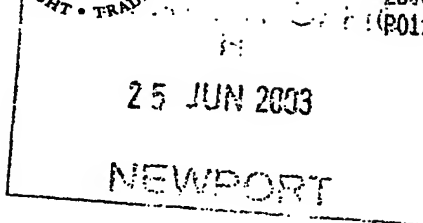
25 JUN 2003



25JUN03 E817621-1 D00125  
(P01/7700 0.00-0314761.8

# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

1. Your reference 0300170

2. Patent application number 0314761.8  
(The Patent Office will fill in this part)

3. Full name, address and postcode of the or of each applicant (underline all surnames)  
SMITHS GROUP PLC  
765 FINCHLEY ROAD  
LONDON  
NW11 8DS

Patents ADP number (if you know it) 8032310001 ✓

If the applicant is a corporate body, give the country/state of its incorporation GB

4. Title of the invention  
IMS SYSTEMS

5. Name of your agent (if you have one) J. M. FLINT

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)  
765 FINCHLEY ROAD  
LONDON  
NW11 8DS

Patents ADP number (if you know it) 1063304001 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number	Country	Priority application number (if you know it)	Date of filing (day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application	Date of filing (day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

a) any applicant named in part 3 is not an inventor, or

b) there is an inventor who is not named as an applicant, or

c) any named applicant is a corporate body.

See note (d))

YES

# Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form  
Do not count copies of the same document

Continuation sheets of this form

Description 5

Claim(s)

Abstract

Drawing(s) 1 + 1

JMC

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

J. M. Flint

Date 24 JUNE 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

J. M. FLINT

020 8457 8220

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## Notes

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- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
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## IMS SYSTEMS

This invention relates to IMS systems.

IMS systems are often used to detect substances such as explosives, drugs, blister and nerve agents or the like. An IMS system typically includes a detector cell to which a sample of air containing a suspected substance is supplied as a gas or vapour. The cell operates at atmospheric pressure and contains electrodes that are energized to produce a voltage gradient across the cell. Molecules in the sample of air are ionized, such as by means of a radioactive source or by corona discharge, and are admitted into the drift region of the cell by an electrostatic gate at one end. The ionized molecules drift to the opposite end of the cell at a speed dependent on the size of the ion. By measuring the time of flight across the cell it is possible to identify the ion. It is common practice to add a reagent or dopant to the cell. The reagent is selected so that it interacts with the substances of interest to produce usually a larger molecule that moves more slowly and can be more readily distinguished from other substances.

Examples of IMS systems are described in GB 2324407, GB 2324875, GB2316490, GB2323165 and US 4551624. US 6459079 describes a system with a positive and a negative cell, which are each supplied with a different reagent. It is common practice for an IMS unit to have two cells of different polarity since this enables the unit to detect nerve agents, which require a positive polarity cell, and blister agents, which require a negative polarity cell. In such arrangements the positive cell is dedicated to the detection of compounds that produce ionized species in the positive mode, such as nerve agents and narcotics and the negative cell

is dedicated to the detection of compounds that produce ionized species in the negative mode, such as blister agents and explosives. Alternatively, some IMS units have only a single cell and the polarity of this is switched between being positive and being negative, the switching period typically being of the order of several seconds. Such an arrangement may be satisfactory in long-term background monitoring but it will be appreciated that the system will not be able to respond to certain substances when it is operating at the wrong polarity for these substances.

It is an object of the present invention to provide an alternative IMS system.

According to one aspect of the present invention there is provided an ion mobility spectrometer system including a first and second IMS cell, means for supplying a vapour or gas to be analysed to both cells, driver means operable to drive the first and second cells at opposite polarities such that the first and second cells are responsive to respective first and second substances different from one another, the driver means being operable to switch the polarity of at least the first cell so that it is responsive to a substance different from the first substance.

The system preferably includes means to dope the cells individually such that the dopant chemistry of each cell can be different. Preferably, the driver means is operable to switch both the first and second cells so that at any time one cell is operating at a positive polarity and the other is operating at a negative polarity. The driver means may be operable to switch polarity of the or each cell at regular intervals, less than about 30 seconds and preferably less than about 1 second. Alternatively, or additionally, the driver means may be

operable to switch polarity of a cell in response to a signal indicative of the presence of a substance. The cells are preferably supplied with reagents chosen to promote detection of the substances. The or each cell that is driven with alternating polarity is preferably supplied with a first reagent for promoting detection of a first group of substances in the positive mode and a second reagent for promoting detection of a second group of substances in the negative mode.

An IMS system according to the present invention, will now be described, by way of example, with reference to the accompanying drawing, which shows the system schematically.

The system includes two conventional IMS drift cells 1 and 2 each having an inlet 3 by which gas or vapour to be analysed is supplied to the cells. The cells also have an inlet 4 by which suitable dopants or reagents are supplied to the cells. The internal construction and operation of the cells is conventional so is not described here. The two cells 1 and 2 provide electrical outputs to a signal processor 10, which provides an output to a display, alarm, external communications or other utilisation means 11. The polarity of the two cells 1 and 2 is controlled by a polarity switching or driver unit 12 in the manner described below.

The unit 12 initially applies a positive polarity to the first cell 1 and a negative polarity to the second cell 2. With these polarities, the first cell 1 is responsive to composition A, typically a blister agent, and the second cell 2 is responsive to composition B, typically a nerve agents. Different reagents are continuously supplied to both cells 1 and 2, namely a first reagent that promotes detection of composition A and a second reagent that promotes

detection of composition B. It will be appreciated that the second reagent is redundant in the first cell 1 while it has a positive polarity and that the first reagent is redundant in the second cell 2 while it has a negative polarity. For this reason, multiple dopants may be added to each cell such that each cell has a number of dopants that affects chemistry in the positive mode as well as dopants that affect chemistry in the negative mode.

The unit 12 subsequently switches the polarities applied to the two cells so that the first cell 1 has a negative polarity and the second cell 2 has a positive polarity. With these polarities the first cell 1 is now responsive to composition B and the second cell 2 is now responsive to composition A. Because the cells 1 and 2 are continuously supplied with both the dopants needed to promote detection of the two compositions A and B there is no delay in switching between reagents.

The unit 12 may be arranged to switch polarity of the cells at regular intervals, typically shorter than about 30 seconds. Alternatively, the unit 12 may be arranged to switch polarity only when the inputs to the processor 10 indicate that a composition has been detected by one or other cell 1 or 2. It can be seen, however, that at any time, one cell will be operating at one polarity and the other cell will be operating at an opposite polarity

If a suspect composition is detected by one cell and then also by the other cell (having a different dopant chemistry) when its polarity is switched, the processor 10 interprets this as indicating a high probability of the presence of the composition. If, however, a composition is detected by one cell but is not detected by the other cell when the polarity is switched, the processor 10 indicates that there is a lower probability of the presence of the composition.



The invention, therefore, by measuring the drift time of ionized species produced in more than one chemistry system, can enable a more reliable assessment of the presence of a substance without undue complexity.

There are various ways in which the system could be modified. For example, the system could have more than two cells, which could be driven with switched polarities or could have a constant polarity. In a system having two cells, there might be situations where it was preferable to have one cell operating continuously at one polarity and to have only the other cell with a switched polarity. Where, for example, it was thought that there was a high risk of a substance that is detected in a positive polarity cell, one cell might be operated continuously with a positive polarity with only the other cell being switched between different polarities. The system could be arranged with both cells initially being driven at different polarities and, when the output of one cell indicates the presence of a suspect composition, that cell could be maintained at its polarity but the polarity of the other cell could be switched to have the same polarity.



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